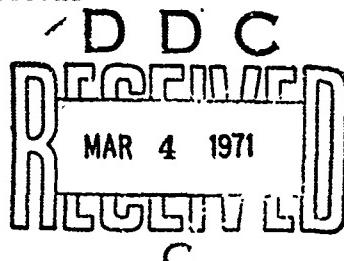


AD719084

15 January 1971

Materiel Test Procedure 2-2-608
Aberdeen Proving Ground



U. S. ARMY TEST AND EVALUATION COMMAND
COMMON ENGINEERING TEST PROCEDURE

BRAKING, WHEELED VEHICLES

1. OBJECTIVE

This Materiel Test Procedure provides standardized tests for evaluating wheeled vehicle braking systems.

2. BACKGROUND

Braking is a basic element of all automotive testing and, because of its association with personnel safety, dictates the requirement for particularly thorough testing and evaluation of wheeled vehicle braking system to assure dependability and effectiveness under all conditions.

Major factors considered in the evaluation of wheeled vehicle braking systems are stopping and holding ability, vehicle control when applying brakes, and individual braking system component endurance under various operating conditions.

Brake testing involves not only tests on straight, level roads but tests on mountain highways that have long grades requiring many brake applications as well. For such tests a specific public highway in Pennsylvania has been authorized. Brake tests also include water immersion of the vehicle in a fording basin.

3. REQUIRED EQUIPMENT

3.1 TEST COURSES

Required test courses are as follows:

- a. A straight, level, paved road with lane width of not less than 12 feet.
- b. Longitudinal slopes ranging from 5 to 60 percent grade and of sufficient length to accommodate military vehicles of various dimensions.
- c. A fording basin of sufficient length and depth to completely submerge the service brake assemblies of all sizes of military wheeled vehicles.
- d. Mountain highway test course (App. A).
- e. A downhill roadway ranging from 9 to 11 percent grade for a distance of approximately 2 miles with a reasonably level surface at the bottom of the grade of sufficient length to permit a 40 mph brake stop.

*Supersedes Interim Pamphlet 60-71.

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3.2 TEST INSTRUMENTATION

Instrumentation required to collect brake test data is as follows:

- a. A fifth wheel equipped with speedometer and tachometer.
- b. Hydraulic pressure gauge with a bleeder screw in the bourdon tube.
- c. Air pressure gauge.
- d. Decelerometer (U-tube type).
- e. Pedal travel gauge.
- f. Pedal effort gauge.
- g. Brake application counter.
- h. Temperature indicating potentiometer.
- i. Thermocouples imbedded in brake friction material.

3.3 SPECIALIZED SHOP EQUIPMENT

Specialized shop equipment and instrumentation required for vehicle preparation and post-test inspection are as follows:

- a. Micrometer calipers (inside, outside, and dial types).
- b. Surface finish gauges.
- c. Torque wrench.
- d. Brake shoe turntable.
- e. Feeler gauge stock.
- f. Tire pressure gauge.

4. REFERENCES

- A. USATECOM Regulation 385-6, Verification of Safety of Material During Testing.
- B. Brake Systems Road Test Code - Truck and Bus, SAE J786.
- C. NEL Standard S-6-66, Human Factors Engineering Design Standard for Wheeled Vehicles.
- D. MTP 2-2-506, Durability Testing of Wheeled Vehicles.
- E. MTP 2-2-508, Safety Evaluation (Automotive).

- F. MTP 2-2-816, High and Low Temperature Tests.
- G. MTP 2-2-650, Cold Starting and Warmup.
- H. AR 385-55, Prevention of Motor Vehicle Accidents.

5. SCOPE

5.1 SUMMARY

This MTP describes specific test phases pertinent to the evaluation of wheeled vehicle braking systems, as follows:

- a. Safety evaluation (par. 6.2.1).
- b. Brake burnish (par. 6.2.2.1).
- c. Brake holding ability (par. 6.2.2.2).
- d. Brake stopping ability (par. 6.2.2.3).
- e. Brake recovery after immersion in water (par. 6.2.2.4).
- f. Trailer breakaway holding ability (par. 6.2.2.5).
- g. Maximum safe braking speed (par. 6.2.2.6).
- h. Brake actuation and release time (par. 6.2.2.7).
- i. Pedal effort (par. 6.2.2.8).
- j. Low temperature effects (par. 6.2.2.9).
- k. Brake fade on mountain highway (par. 6.2.3.1).
- l. High temperature endurance on mountain highway (par. 6.2.3.2).
- m. Brake endurance and wear (par. 6.2.4).

5.2 LIMITATIONS

This MTP is applicable only to wheeled type vehicles designed for highway operation.

Vehicles designed specifically for off-highway operation that do not possess a maximum vehicle speed capability of at least 40 mph will be considered on an individual basis. Specific test parameters and criteria will be provided in plans of test prepared for each peculiar vehicle design.

Evaluation of vehicle retarding systems other than the installed foundation service braking systems will be considered in a separate MTP.

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6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Preparation of Test Vehicle and Instrumentation

The vehicle power train, braking, steering, and electrical systems are prepared for optimum operation..

Proper vehicle weight distribution, lubrication, and tire inflation pressures are assured.

For mountain highway brake tests a yellow and black diagonally striped signboard is mounted at the rear of the vehicle, displaying 6-inch-diameter stoplights and turning signals.

All instruments are calibrated before and after a test and, if necessary, during the test.

6.1.2 Restrictions

Tests are not conducted at night, during inclement weather, in congested traffic, or when the road surface may introduce a hazard to the test vehicle or other traffic on the road. Dry, un-obstructed surfaces are used unless the test plan introduces a specific requirement. Local safety and operating procedures will be carefully followed.

6.2 TEST CONDUCT

6.2.1 Safety Evaluation

Prior to the conduct of other wheeled vehicle braking system tests, tests will be conducted to accumulate data on which to base a recommendation for the issuance of a safety release (USATECOM Reg. 385-6).

A safety evaluation of the vehicle braking system will consist of the following performance tests:

- a. Brake burnish (par. 6.2.2.1).
- b. Holding ability (par. 6.2.2.2).
- c. Stopping ability (par. 6.2.2.3).
- d. Brake recovery after immersion in water (par. 6.2.2.4).
- e. Trailer breakaway holding ability (par. 6.2.2.5).
- f. Determination of the maximum safe speed for maximum pedal effort braking (par. 6.2.2.6).

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Tests performed during the safety evaluation usually will not require duplication during the other test phases; safety observations are continued, however, through all phases of brake testing.

Criteria for safe performance are described in the following paragraphs devoted to specific performance test phases.

6.2.2 Performance Tests

Brake performance will be evaluated in terms of adequacy of the vehicle braking system to perform at the required level for each test phase.

6.2.2.1 Brake Burnish

Friction material burnishing is accomplished by either the burnish procedure of SAE J786 or the procedure outlined in Appendix B.

The criterion for friction material burnishing is that not less than 80 percent of the friction material surface area be in contact with the swept area of the rotating brake member (drum or disk).

6.2.2.2 Brake Holding Ability

The vehicle is parked on dry, paved, longitudinal slopes in both ascending and descending attitudes. Service and parking brake systems are engaged individually to assure their individual capability to hold the vehicle stationary.

The criterion for brake holding ability for both service and parking brake systems of wheeled vehicles is that each system, independent of the other, hold the vehicle stationary in both ascending and descending attitudes on the maximum longitudinal slope over which the vehicle is required to operate.

6.2.2.3 Brake Stopping Ability

Brake stopping distances are obtained from 20 and 40 mph and from additional road speeds if specifically requested. Stopping distances are measured over the input pressure range up to the point of wheel locking. Data collected will include road speed, stopping distance, deceleration rate, input pressure, wheel locking, and vehicle slew. Brake drum temperatures should not exceed 250°F, or otherwise as specified, during these tests. For electrical braking systems, voltage and current measurements will be recorded in place of input pressures. These tests will be conducted on a level, hard-surfaced roadway with the vehicle at curb weight and at its rated payload condition.

The criteria for brake stopping ability are as follows:

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a. Wheeled vehicles of gross vehicle weights up to and including 50,000 pounds will be capable of making a straight line full stop from a road speed of 20 mph within a distance of 30 feet; they will be capable of making a full stop from a vehicle speed of not less than 40 mph at an average deceleration rate of 14.4 ft/sec².

b. Wheeled vehicles of gross vehicle weights exceeding 50,000 pounds will be capable of making a straight line full stop from a road speed of 20 mph within a distance of 40 feet; they will be capable of making a full stop from a vehicle speed of not less than 40 mph at an average deceleration rate of 11 ft/sec².

c. During all brake stops, vehicle slew shall not exceed the limits of a roadway lane width equal to 1-1/2 times the overall width of the test vehicle.

6.2.2.4 Brake Recovery after Immersion in Water

Wheeled vehicle braking systems will be completely submerged in water for a period of 15 to 30 minutes. After immersion, recovery is determined by making brake applications from a road speed of 20 mph at a pre-selected input pressure at 1-minute intervals. Data required will include time, road speed, number of applications, input pressure, deceleration rate, and distance traveled. Results will be compared to the dry brake performance previously established for the vehicle.

The criterion for brake recovery is that after immersion in water for a period of 15 to 30 minutes, brake stopping ability shall have achieved complete recovery after 10 brake applications over a period of 12 minutes.

6.2.2.5 Trailer Breakaway Holding Ability

This test phase will be performed in both ascending and descending attitudes on paved, longitudinal slopes. The trailers will be parked on the grade and brake lines disconnected to actuate the breakaway feature. Local safety regulations will be followed.

The criterion for trailer breakaway holding ability is that the safety brake feature be capable of holding the vehicle stationary in both ascending and descending attitudes on the maximum slope over which the vehicle is designed to operate for a period of 30 minutes. The maximum grade will be designated in the plan of test for each specific vehicle.

6.2.2.6 Maximum Pedal Effort Braking

Maximum pedal effort brake stops will be made in the forward vehicle direction of a dry, level, paved surface at 5-mph road speed increments over a speed range span of 20 mph to maximum vehicle speed (or to the highest speed where safe maximum pedal effort braking can be achieved)

and in the reverse vehicle direction at a road speed of 5 mph. Data recorded will include road speed, stopping distance, deceleration rate, wheel locking, and vehicle slew; and data obtained by inspection of wheel, brake, and suspension system components.

For maximum pedal effort braking, wheeled vehicles must be capable of making maximum pedal effort brake stops in both forward and reverse directions without damage to the brake, wheel, or suspension systems as follows:

- a. Reverse direction - at road speeds up to 5 mph.
- b. Forward direction - at road speeds up to 50 mph (essential).
- at road speeds up to maximum vehicle speed (desirable).

NOTE: If maximum vehicle speed is less than 50 mph, a road speed test at maximum vehicle speed will be considered essential.

The criterion for maximum safe speed at maximum pedal effort is that vehicle slew shall not exceed the limits of a roadway lane width equal to 1-1/2 times the overall width of the test vehicle.

6.2.2.7 Brake Actuation and Release Time

The time lapse between brake application, actuation, and release will be determined by means of a recording device triggered by switches installed at the application mechanism and at the point where the brake friction material contacts the rotating member. Brake input pressure will be measured at the input source and at the brake location farthest from the input source. Data recorded will include time and input pressure.

The criterion for brake actuation and release time will be peculiar to each specific vehicle design and will be dependent upon data collected during stopping ability tests (6.2.2.3 above), such as premature wheel locking or unbalanced braking.

6.2.2.8 Pedal Effort vs Input Pressure

Pedal effort and input pressure will be recorded under static conditions over the complete input pressure range of the brake actuation supply system. Data will be measured by suitable pedal effort and input pressure gauges.

The criterion for pedal effort is that vehicle stopping ability be in accordance with the criteria stated in 6.2.2.3, above, at a pedal force designated in the plan of test for each specific vehicle test program. In the absence of specific criteria, a maximum pedal force of 200 pounds will be used (Ref. 4.C).

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6.2.2.9 Low Temperature Effects

This test is conducted to assure satisfactory operation of the moving components of the braking system under extreme cold environmental conditions. Testing is accomplished by actuating the braking system while the vehicle is stationary. This test is usually accomplished during other cold tests (MTP 2-2-650 and MTP 2-2-816).

The criterion for this test is that braking system components function satisfactorily at ambient air temperatures designated in the plan of test for each specific vehicle without damage to seals, gaskets, or moving parts. In the absence of a specific standard, -50°F will be used.

6.2.3 Mountain Highway Brake System Tests

These tests are designed to be conducted over a 25-mile section of U. S. Route 30 in the Jennerstown area of western Pennsylvania. Test data to be recorded are indicated in Appendixes A, B and C.

6.2.3.1 Brake Fade Test

Brake fade characteristics will be determined during repeated braking operation over a downhill roadway of approximately 9 to 11 percent grade over a distance of approximately 2 miles and a 40-mph full stop at the bottom of the grade.

Fade test procedures will vary for vehicles of gross vehicle weight classifications as shown in Appendix A, item 13.

The criteria for brake fade are:

a. Immediately following the downgrade brake snubbing procedure, the test vehicle must demonstrate the capability of making a full stop at the bottom of the grade as indicated in the following table:

<u>Gross Vehicle Weight - Lb.</u>	<u>Déceleration Rate - Ft/Sec²</u>	<u>Initial Braking Speed - Mph</u>
Up to 12,000	14.4	40
12,000 to 50,000	14.4	40
Over 50,000	11.3	30

b. Vehicle slew shall not exceed roadway lane width limits equal to 1-1/2 times the overall width of the test vehicle.

6.2.3.2 High Temperature Endurance Test

A high temperature highway brake test is conducted for the

purpose of evaluating the performance, fade, wear, and endurance characteristics of wheeled vehicle braking systems under conditions where elevated brake system temperatures and braking torques are a factor. The specific test procedure is outlined in Appendix A.

NOTE: Since the temperatures reached by the brake linings may be as high as 600° to 800° F, climatic testing in the hot-dry conditions specified in AR 70-38 is not necessary because the temperatures produced would be only insignificantly higher than those obtained at standard temperatures.

The criteria are:

a. After the complete mountain highway brake test, brake component deterioration shall not have reduced vehicle stopping ability to a point below the minimum requirements stated in paragraph 6.2.2.3.

b. Damage to brake, wheel, and suspension system components, such as bending, twisting, or breakage, shall not occur as a result of test operation.

6.2.4 Brake Endurance Test

The mileages accumulated during tests outlined in MTP 2-2-506 will be used for brake endurance evaluation as applicable for off-highway and general operation. Various components of wheeled vehicle braking systems are subject to failure during these tests due to contamination by foreign abrasives and lubricants. Test operators will report incipient failures during the conduct of these tests for the determination of causes of specific malfunctions. During the tests all failed parts will be labeled and retained along with samples of brake fluids and contaminating elements.

The criteria for off-highway braking system endurance are:

a. Brake component wear attributable to abrasives accumulated during normal vehicle endurance testing shall not reduce vehicle stopping ability to a point below the minimum requirements stated in paragraph 6.2.2.3 over an accumulated span of 560 miles when test course surfaces are in a wet, muddy condition.

b. Damage to brake, wheel, and suspension system components, such as bending, twisting, or breakage, shall not occur as a result of test operation.

6.3 TEST DATA

All pertinent data will be recorded during the conduct of all braking system tests. Data record sheets shown in Appendix C will be used during collection of test data.

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6.4 DATA REDUCTION AND PRESENTATION

Data reduction and presentation requirements depend upon the extent of the test conducted. The following presentations are representative:

a. Graphs:

Pedal effort vs input pressure
Brake effectiveness vs input pressure.
Brake fade vs number of applications.
Brake recovery vs number of applications.

b. Tabulations:

Brake temperature data.
Brake component wear.

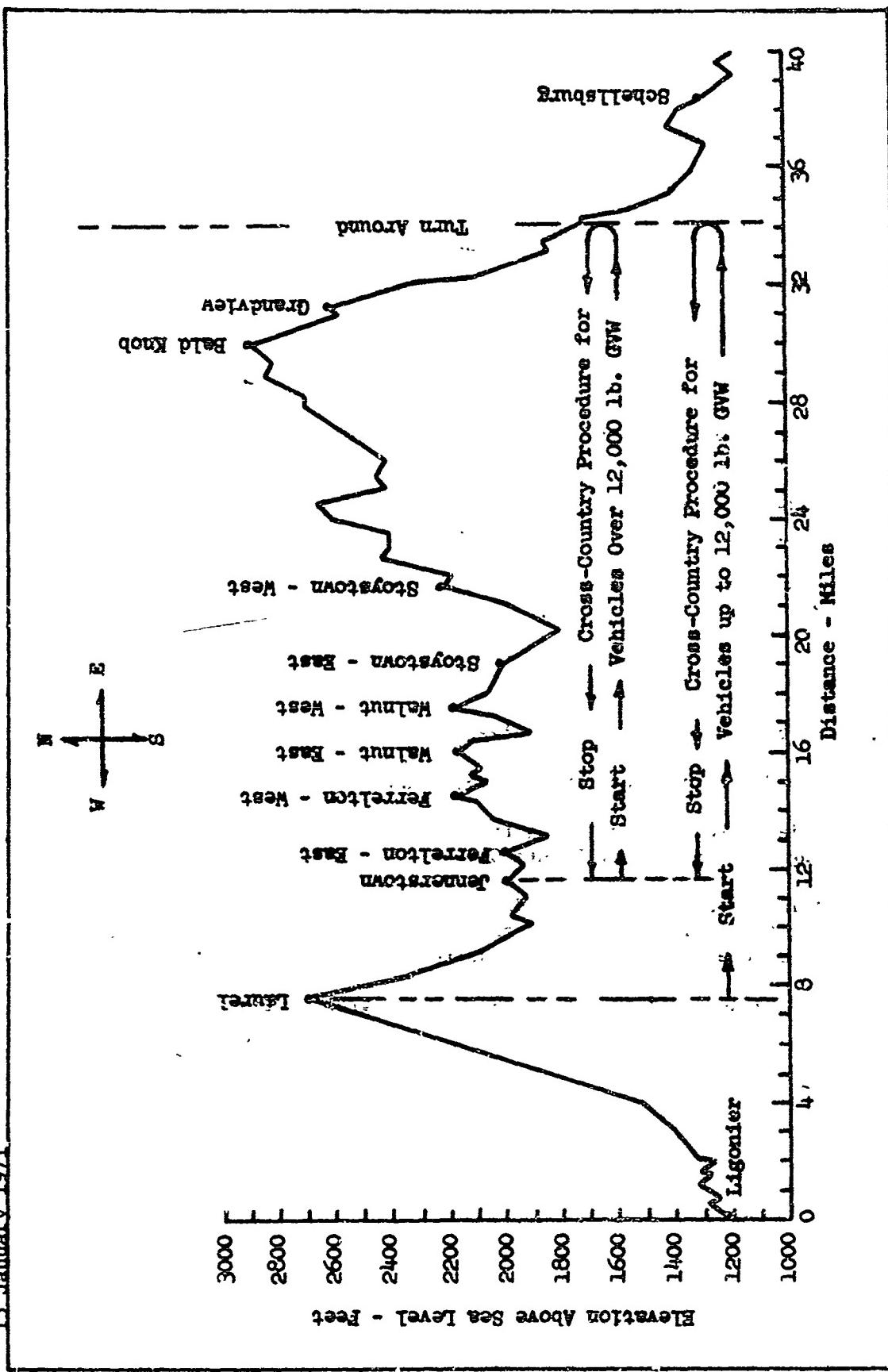
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APPENDIX A

MOUNTAIN HIGHWAY BRAKE TEST OUTLINE

1. Disassemble brake system completely.
2. Provide all new brake components.
3. Make pertinent initial brake component measurements.
4. Install calibrated brake test instrumentation (pars. 3.2 and 6.1.1).
5. Reassemble brake system.
6. Adjust lining material to drum clearances to manufacturer's specifications.
7. Bleed hydraulically actuated brake systems per manufacturer's recommended procedure.
8. Run preburnish effectiveness tests from 20 mph.
9. Burnish brakes to achieve at least 80 percent contact between the surface areas of the lining and the drum (use either SAE J786 or APG procedure summarized in App. B).
10. Readjust brakes to recommended clearances.
11. Measure pedal force requirements over brake input pressure range.
12. Run initial effectiveness tests from 20 and 40 mph (Ref. Par. 6.2.2.3), recording data on form of Figure C-9.
13. Run initial fade tests (east side of Laurel Mountain, Fig. A-1), operating the vehicle downgrade and accelerating between brake applications as necessary to achieve required number of applications.
 - a. Snubbing and stopping rates per vehicle gross weight are as follows:

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Figure A-1. Mountain Brake Test Course, Jennerstown, Pennsylvania, U. S. Route 30.

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- GVW up to 12,000 lb. - 18 applications from 40 to 20 mph at 8 ft/sec² in highest gear range.
One application from 40 to 0 mph at 14.4 ft/sec² at bottom of grade.
- GVW 12,000 to 50,000 lb. - 36 applications from 30 to 25 mph at 8 ft/sec² in highest gear range.
One application from 40 to 0 mph at 14.4 ft/sec² at bottom of grade.
- GVW over 50,000 lb. - 36 applications from 30 to 25 mph at 8 ft/sec² in highest gear range.
One application from 30 to 0 mph at 11.0 ft/sec² at bottom of grade.
- b. Data recorded (Fig. C-3) will include road speed, deceleration rates, input pressure, pedal travel, brake friction material temperatures, stopping distance, wheel locking, and vehicle slew.
14. Run cross-country cycle No. 1 - Four round trips starting at 100°F brake lining temperature.
- GVW up to 12,000 - Follow procedure outlined in Appendix C, Fig. C-1.
 - GVW over 12,000 lb. - Follow procedure outlined in Appendix C, Fig. C-2.
15. Run effectiveness test.
16. Run fade test.
17. a. Inspect brake system
b. Readjust brakes.
c. Bleed hydraulic system.
d. Measure lining thickness at outside of shoes.
18. Run cross-country cycle No. 2 - Four round trips starting at 100°F brake lining temperature.
19. Run effectiveness test.
20. Run fade test.
21. Run cross-country cycle No. 3 - Four round trips starting at 100°F brake lining temperature.
22. Run effectiveness test.
23. Run fade test.

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24. Make pertinent final brake component measurements.
25. Remove instrumentation.
26. Reassemble brake system.

APPENDIX B

BRAKE BURNISH PROCEDURE

Gross Vehicle Weight			
Under 12,000 Lb.	12,000 to 50,000 Lb.	Over 50,000 Lb.	
			At 10 ft/sec ² from 20 to 0 mph
			At 12 ft/sec ² from 30 to 0 mph
			At 10 ft/sec ² from 20 to 0 mph
			At 8 ft/sec ² from 40 to 15 mph
			At 6 ft/sec ² from 30 to 15 mph
			At 12 ft/sec ² from 30 to 0 mph
			At 10 ft/sec ² from 40 to 0 mph
			At 12 ft/sec ² from 30 to 0 mph

1. Baseline Brake Effectiveness

- Make three full stops at lining temperatures under 200°F.
- Measure lining temperature before each application.
- Measure initial and final input pressures.
- Measure stopping distance.
- Record vehicle instability, brake noise, and wheel locking.

2. Applications to 300°F

- Make brake applications at 1-mile intervals until hottest brake reaches 300°F.
- Measure lining temperature at start and after every fifth application.
- Measure initial and final input pressures during each fifth application.

3. Hot Stop

- Make one full stop immediately after hottest brake reaches 300°F.
- Measure initial and final input pressures.
- Measure stopping distance.
- Record vehicle instability, brake noise, and wheel locking.

4. Cooling Period

- Stop vehicle and let brakes cool to under 100°F at all wheel locations.
- Record stop time.

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5. Effectiveness Check - Repeat par. 1.
6. Test to 400°F.
 - a. Repeat par. 2 until hottest brake reaches 400°F.
 - b. Repeat par. 3 at 400°F.
 - c. Repeat par. 4.
 - d. Readjust brake clearances.
 - e. Repeat par. 1.
7. Test to 475°F.
 - a. Repeat par. 2 at consecutive intervals until hottest brake reaches 475°F.
 - b. Repeat par. 3 at 475°F.
 - c. Repeat par. 4.
 - d. Repeat par. 1.
8. Review of Results
 - a. Check data for stabilization of both input pressures and stopping distances.
 - b. Check for temperature balance of not more than 50°F from wheel to wheel.
 - c. Inspect brake shoes to insure 80% contact.
 - d. If these conditions are not satisfactory, readjust brakes and repeat pars. 1, 2, 3, and 4 until stabilization of pressure and temperature data occurs and 80% contact area is achieved.

WHEELED VEHICLE BRAKE TEST DATA SHEET'S ENGINEERING AND ENVIRONMENTAL TEST SECTION, MD, AFSC, MD.											
MOUNTAIN BRAKE TEST - JENNERSTOWN, PENNSYLVANIA											
VEHICLE	USA REG. NO.			TRIP NO.							
ODOMETER	START	FINISH	TOTAL	BRAKE SYSTEM	DATE	OBSERVER	DRIVER				
COUNTER											
TIME											
AMBIENT					TEMPERATURE - °F						
LOCATION	MPH	APPL's	L.P.	S	1	2	3	4	5	6	TOTAL
LAUREL HILL - E.	TOP	40-20	12								
	BOT.										
	RISE										
1st HILL E. OF JENNERSTOWN	40-20	1									
FERRELTON HILL - EAST	30-20	5									
1st HILL E. OF FERRELTON	40-20	2									
WALNUT HILL - EAST	TOP	40-20	4								
	BOT										
1st HILL E. OF WALNUT	40-20	2									
STOYSTOWN - EAST	TOP	40-20	7								
	BOT.										
	RISE										
SEVEN MILE STRETCH - E.	40-20	10									
BALD KNOB	TOP	35-25	36								
	BOT.										
GRANDVIEW	TOP.										
SHIP HOTEL											
SHOT HOUSE											
FIG TREE TUNNEL											
GRANDVIEW	BOT.										
	RISE										
BOT. GRANDVIEW - 1 REV. APPL @ 50% INPUT PRESS											
SEVEN MILE STRETCH - W.	40-20	10									
LOWVIEW HILL	40-20	3									
FT. EMERALD PARK	40-0	1		TO							
STOYSTOWN - WEST	TOP	40-20	10								
	BOT										
	RISE										
1st HILL W. OF STOYSTOWN - E	40-20	3									
WALNUT HILL - WEST	TOP	40-20	6								
	BOT.										
1st HILL W. OF WALNUT	40-20	2									
FERRELTON HILL - W.	TOP	40-20	4								
	BOT.										
FERRELTON TO JENNERSTOWN	40-20	1									
JENNERSTOWN - END	STOP										
	RISE										

Figure C-1 Mountain Brake Test, Cross-Country, for Trucks up to 12,000 Pounds Gross Vehicle Weight

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ENGINEERING AND ENVIRONMENTAL TEST SECTION, MID, APG, MD.

Mountain Brake Test - JEFFERSON, PENNSYLVANIA

VEHICLE	USA REG. NO.			NAME OF DRIVEN	TRIP NO. DRIVER OBSERVER DATE
	START	STOP	NET		
ODOMETER					
COUNTER					
TIME					
AMBIENT					
				DECCEL. RATE	FT/SEC ²
U. S. RT. 30 - EAST				LINING TEMPERATURE - °F	
LOCATION	MPH	APPL'S L.P.	S 1 2 3 4 5 6 7 8		
1st HILL E. OF J-TOWN	35-30	3			
FERRELTON HILL - TOP	30-25	10			
	BOT.				
	RISE				
1st HILL E. OF FERRELTON	35-30	6			
WALNUT HILL - EAST - TOP	30-25	12			
	BOT.				
	RISE				
1st HILL E. OF WALNUT	35-30	4			
STOYSTOWN - EAST - TOP	30-25	20			
	BOT.				
	RISE				
SEVEN MILE STRETCH - E.	35-30				
BALD KNOB	TOP	30-25	45		
	BOT.			NOTE:	
GRANDVIEW	TOP				
SHIP HOTEL					
SHOT HOUSE					
PIG PEN TURN					
GRANDVIEW	BOT.				
	RISE				
BOT. GRANDVIEW - 1st HILL APPL'S L.P. TO THE P.M.				TO	FT @ 15 FT/SEC ²
U. S. RT. 30 WEST					
SEVEN MILE STRETCH - W.	35-30	12			
LONGWYN HILL	35-30	4			
PT. EMERALD PARK	40-0	1			
STOYSTOWN - WEST - TOP	30-25	20			
	BOT.				
	RISE				
1st HILL W. OF STOYSTOWN	35-30	6			
WALNUT HILL - WEST - TOP	30-25	17			
	BOT.				
	RISE				
1st HILL W. OF WALNUT	35-30	5			
FERRELTON HILL - W. TOP	30-25	10			
	BOT.				
	RISE				
FERRELTON TO JEFFERSON	35-30	3			
JEFFERSON	STOP				
	START				
	RISE				

Figure C-2. Mountain Brake Test, Cross-Country, for Trucks Over 12,000 Pounds Gross Vehicle Weight.

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ENGINEERING AND ENVIRONMENTAL TEST SECTION, MDL, APG, MD.							
LAUREL BRAKE FADE TEST, U.S. RT. 30, PENNSYLVANIA							
TEST VEHICLE	TEA REG. NO.	VEH. WT.	LB	DRIVER	CO-PILOT	TIME	ROAD SURFACE
TRIP NO.	DATE	TIME	'P,	WEATHER	WEATHER	HRS. AND TEMP.	
BRAKE APPLICATIONS		TO	MPH @	FT/SEC ²			
LINING TEMP. °F		1	2	3	4	5	6
STOP	-	-	-	-	-	-	-
START	-	-	-	-	-	-	-
RIDE	-	-	-	-	-	-	-
TOTAL							
APPL'S	P.T.	INPUT PRESS - PSI	NOTES	APPL'S	P.T.	INPUT PRESS - PSI	NOTES
1				26			
2				27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			
25				50			
LIGHT TRUCKS EAST SLOPE				HEAVY TRUCKS EAST SLOPE			
				FIRE TRUCKS WEST SLOPE			
FULL STOP @ BOTTOM OF GRADE -				TO	MPH @ 15 FT/SEC ²		
INPUT PRESS. - INITIAL				PSI, FINAL	PSI.		
STOPPING DISTANCE -				UNITS,	FEET.		
PEDAL TRAVEL -				IN.,	VEHICLE STABILITY		
NOTES:							
<hr/> <hr/> <hr/>							

Figure C-3. Mountain Brake Fade Test.

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**ENGINEERING AND ENVIRONMENTAL TEST SECTION, NED
AERODRAG PROFESSIONAL GROUP, MD.**

Figure C-4. Brake Shoe Grind Radius Fall-off.

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ENGINEERING AND ENVIRONMENTAL TEST SECTION, MTD ABERDEEN PROVING GROUND, MARYLAND												
BRAKE LINING MEASUREMENTS												
DATE: START	STOP			TOTAL								
ODOM: START	STOP			MILES								
TEST VEHICLE	USA REG. NO.			TEST WT.			LB.					
BRAKE	SIZE			GRIND RADIUS			IN.			IN.		
BRAKE LOCATION _____												
SHOE LOCATION _____												
LINING MATERIAL _____ MPGR. _____												
LENGTH	IN., WIDTH	IN., THICKNESS	IN.	RIVET DEPTH	IN.							
LOCATION	OUTSIDE			INSIDE			WEAR		DETERIORATION			
	START	STOP	WEAR	START	STOP	WEAR	Avg.	Max.				
	TOE											
	CENTER											
HEEL												
AVERAGE												
NOTES:												
SHOE LOCATION _____												
LINING MATERIAL _____, MPGR. _____												
LENGTH	IN., WIDTH	IN., THICKNESS	IN.	RIVET DEPTH	IN.							
LOCATION	OUTSIDE			INSIDE			WEAR		DETERIORATION			
	START	STOP	WEAR	START	STOP	WEAR	Avg.	Max.				
	TOE											
	CENTER											
HEEL												
AVERAGE												
NOTES:												

Figure C-5. Brake Lining Measurements.
C-5

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ENGINEERING AND ENVIRONMENTAL TEST SECTION, MTD, APG, MD.
BRAKE DRUM MEASUREMENTS

VEHICLE	DRUM TYPE											
	DATE: START			STOP			TEST			TOTAL		
OD/W:	START	STOP	TOP	START	STOP	WEAR	START	STOP	WEAR	START	STOP	WEAR
LOCATION 90°	1	2	3	4								
OPENING	START	STOP	WEAR	START	STOP	WEAR	START	STOP	WEAR	START	STOP	WEAR
CENTER												
FACE PLATE												
OPENING												
CENTER												
FACE PLATE												
AVERAGE												
LOCATION 90°	5	6	7	8								
OPENING	START	STOP	WEAR	START	STOP	WEAR	START	STOP	WEAR	START	STOP	WEAR
CENTER												
FACE PLATE												
OPENING												
CENTER												
FACE PLATE												
AVERAGE												
DRUM	OUT-OF-ROUND IN.			WEIGHT			SURFACE FINISH - MI.					
	1	START	STOP	LB	0°	120°	240°	0°	120°	240°		
	2											
	3											
	4											
	5											
	6											
	7											
	8											
NOTES:												

Figure C-6. Brake Drum Measurements
C-6

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ENGINEERING AND ENVIRONMENTAL TEST SECTION, MTD ABERDEEN PROVING GROUND, MARYLAND						
BACKING PLATE LEDGE MEASUREMENTS - IN.						
DATE:	START	STOP	TOTAL			
ODOM:	START	STOP	MILES			
BRAKE SYSTEM			MFGR.			
SIZE	ANCHOR PIN	IN. DIAM.	IN. RADIUS			
VEHICLE	USA REG. NO.	TEST WT.	LB.			
BRAKE	ANCHOR PIN	LEDGE LOCATION IN DIRECTION OF ROTATION				
LOCATION	DIAM-IN.	1	2	3	4	5
1 START						
STOP						
CHANGE						
2 START						
STOP						
CHANGE						
3 START						
STOP						
CHANGE						
4 START						
STOP						
CHANGE						
5 START						
STOP						
CHANGE						
6 START						
STOP						
CHANGE						
7 START						
STOP						
CHANGE						
8 START						
STOP						
CHANGE						

Figure C-7. Backing Plate Ledge Measurements
C-7

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ENGINEERING AND ENVIRONMENTAL TEST SECTION				VEHICLE		DATE _____											
				USA REG. NO. _____		SHEET NO. _____											
				BRAKE SYSTEM		AMBIENT											
				VEHICLE WEIGHT		•F											
				ODOMETER - START		STOP											
				DECEL ROAD RATE SPEED PRESS - PSI DISTANCE		LINING TEMPERATURE - •F											
				HOURS MILES	KPH MPH	INITIAL	FINAL	UNITS FEET	1	2	3	4	5	6	7	8	MAXIMUM
INITIAL EFFECTIVENESS																	
APPLICATIONS @				INTERVALS -		HOT TEMP.		•F @ HOTTEST BRAKE									
				START	NOISE	NOTES											
				1													
				2													
				3													
				4													
				5													
				10													
				15													
				20													
				25													
				30													
				35													
				40													
				45													
				50													
HOT STOP				COOLING PERIOD		MINUTES. ALL BRAKES UNDER 100° F											
FINAL EFFECTIVENESS																	
NOTES:																	

Figure C-8. Brake Burnish Data

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Figure C-9. Brake Effectiveness Test

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13. ABSTRACT Procedures are described for evaluating the braking ability of wheeled vehicles from at gross weights up to, and in excess of 50,000 lbs. Water immersion, high and low temperature operation, and breaking effectiveness are described.)		

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		ROLE	WT	ROLE	WT	ROLE	WT
	Braking ability Brake burnish Brake immersion Brake Fade						

